



NYS, Department of State Division of Coastal Resources South Shore Estuary Reserve Council



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1. BACKGROUND

The Long Island South Shore Estuary Reserve (SSER) is one of New York State's most diverse and valuable estuaries. It is comprised of over 170 square miles of bays, 51 water body segments, and a watershed exceeding 325 square miles. The Reserve spans a 75 mile section of Long Island's South Shore from the western Nassau County line to the eastern reaches of Shinnecock Bay in the Town of Southampton in Suffolk County. An aerial view of the Reserve appears on the following page.

The Reserve's bays and tidal tributaries provide a habitat for a diverse variety of marine life that, in turn, support recreational and commercial fishing and shell fishing. Public use and enjoyment of the Reserve include recreational boating, sailing and other water sports. This estuary has been dubbed as "the anchor of the region's tourism, seafood and recreational industry". The survival of the ecosystem and man's continued use and enjoyment of this Estuary depend on maintaining and improving the water quality. Accordingly, the SSER has partnered with the New York State Oceans and Great Lakes Ecosystem Conservation Council (OGLECC) to initiate an Ecosystem-Based Management program to protect and preserve the estuary and its many resources. "Ecosystem-based Management is a term used to describe a new approach to managing the natural systems and humans that thrive together in our communities. It is a way in which we look at how humans can help keep the natural environment and water-based economy of our estuary productive by ensuring that the interactions between humans and the components and resources of the estuarine system (shellfish, tidal marshes, seagrass meadows, fish, scenic views, recreational opportunities, etc.) can be sustained as a healthy system and provide for future use." Source : New York Oceans and Great Lakes Ecosystem Conservation Council (OGLECC), 9/12/07. Newsletter: Article: *Great South Bay Ecosystem-based Management Initiative*

Pursuant to the Long Island South Shore Estuary Reserve Act, the South Shore Estuary Reserve Council (the Council) prepared a Comprehensive Management Plan (the Plan) for the Reserve. One of the primary objectives of the Plan is to improve and maintain water quality. Chapter 2, page 10 of the Plan states that "non-point source pollution... poses potential hazards to human health, causes the periodic closures of bathing beaches, and has forced the closure of approximately 34,643 acres of hard clam beds in the Reserve." In addition, "Polluted stormwater runoff alone is the principal source of nonpoint source pollution in 48 of 51 water body segments in the Reserve with use impairments."

The pipe outfalls and related drainage infrastructure discharging into the Reserve fall under the jurisdiction of the state, county, town, city and village governmental entities that own the respective source road systems. This infrastructure has evolved over decades and has been constructed piecemeal as a part of residential development, road improvements, or to solve localized flooding problems. Often, drainage systems of neighboring municipal jurisdictions are interconnected, resulting in discharging piping networks that may be a combined system of parts of drainage elements from multiple municipalities. 'As Built' construction plans of drainage systems often reside in paper

files stored in various places. Occasionally, no drainage system records or plans exist. The governmental entities abutting the Reserve and its 106 sub-watersheds include:

- New York State (i.e., NYSDOT)
- Counties of Nassau and Suffolk
- Towns of Hempstead, Oyster Bay, Babylon, Islip, Brookhaven and Southampton
- City of Long Beach
- 30 village governments (See Methodology for list)

All of these municipal entities are regulated by the Phase II Stormwater Rule of the Federal Clean Water Act. Since March 2003, they discharge stormwater pursuant to a New York State Department of Environmental Conservation (DEC) SPDES General Permit. As a permit condition, each has prepared a 5-year Storm Water Management Plan (SWMP) to address the six minimum control measures contained in the regulatory requirement. To address the minimum control measure of Detection and Elimination of Illicit Discharges, established to track and eliminate illicit discharges, and to delineate storm sewersheds, each of these municipalities must map their discharge points to surface waters and other Municipal Separate Storm Sewer Systems (MS4s) storm sewer system components. Some are going beyond this minimum requirement and are mapping their piping networks and inlet structures as well. Source: New York State DEC, Fact Sheet, *SPDES General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s) (GP-0-08-002)*



2. PURPOSE

To determine the extent of the areas discharging to the Reserve, and to provide a more accurate and objective characterization of the quantity of the stormwater nonpoint sources, the municipal drainage infrastructure leading to the 106 Reserve watersheds must first be identified. The goal of this project is to provide the SSER with an inventory and assessment of geographic information systems (GIS) drainage mapping efforts of all of the state, county, town, city and village governments within the Reserve.

GIS mapping is one tool used by municipalities to detect and eliminate illicit discharges to their storm sewer systems. With this information, the Council will be able to make informed recommendations on programs that implement best management practices and for the design and placement of projects to improve water quality in the priority water bodies identified in the Plan.

Mapping the various municipal stormwater systems, using a GIS with common attributes and protocols, allows for the merging of various pipe network maps, thereby permitting a more accurate and objective characterization of sources of stormwater pollution. Improved information about these sources and impacts will help promote design and site location of cost effective projects and efficient programs to mitigate pollution.

3. METHODOLOGY

To accomplish the foregoing, the Bowne AE&T Group (Bowne) contacted the 39 municipalities that share a watershed with the Reserve to determine their level of storm water infrastructure mapping.

Working closely with the SSER council, Bowne developed a questionnaire (Appendix A) designed to extract, from each of the 39 participating government entities, the most pertinent information related to drainage data collection. The municipalities completed the questionnaires and returned them to Bowne for inclusion in the inventory. Initially distributed in August of 2006, the last completed questionnaire was returned to Bowne in September of 2007.

Upon receipt, Bowne compiled the information from the government entities in a Microsoft Access database.

Analysis of the municipalities' data enabled Bowne to prepare a comprehensive inventory and assessment report. This document identifies where assistance is needed.

The scope of this report includes:

- A narrative of the findings, conclusions and recommendations
- A GIS map showing the status (complete, in-progress, planned or not planned) of the mapping effort of each governmental entity (GE) for each of the 77 watersheds
- For those GEs with planned or ongoing efforts, a timeline for completion of the mapping projects
- A summary of the means, methods and specifications used by each GE and how these compare with NYSDEC guidance
- A data dictionary that contains the data attributes used by the GEs in their mapping efforts
- Recommendations for standardizing means, methods, attributes and terminologies for ongoing and future mapping projects.

Ideally, all of the separate municipal maps will be ultimately stored in a common GIS format in accordance with NYS DEC standards. Additionally, a seamless display of the entire drainage infrastructure throughout the 75-mile extent of the Reserve would provide the best spatial basis for drainage analysis.

4. FINDINGS

4.1 GENERAL

Over the last century, municipal drainage systems have evolved and grown as Long Island developed. These systems were not built according to comprehensive watershed master plans, but rather as a means to solve localized drainage issues as land development created the need. State, county, town, city, and village pipe systems are interconnected sporadically within watersheds. Each government entity often has plans of their part of the system, but there are no comprehensive drainage plans that show how these different systems are interconnected. Though stormwater follows no political bounds, quite often, neighboring municipalities do not perform cooperative drainage system mapping.

Of the 39 government entities that were included in the drainage infrastructure questionnaire, 10 report having completed the mapping of their drainage infrastructure. Though reporting 100% on the questionnaire, these government entities record and maintain varying levels of detail regarding their drainage systems. The Village of Hempstead, for example, reports having completed their mapping effort, but it is limited to outfalls. They report collecting no pipe, manhole, or catch basin data. The Village is compliant with the regulations of NYS Phase II, which only requires the identification of drainage discharge points to surface waters and other MS4 components. Similarly, the Village of Saltaire reports having mapped 100% of their drainage system. They, however, have no drainage structures, therefore a complete stormwater conveyance map for Saltaire is simply a street map, as roads can act as a mechanism for runoff of an MS4 stormwater conveyance system.

In contrast, some government entities that report mapping 100% of their drainage system collect data for their entire drainage system, including pipes, manholes and catch basins. One such municipality is the Village of Babylon. Babylon Village reports collecting 100% of their drainage pipes, manholes, catch basins, culverts, channels, ditches, tide gates and treatment devices in the form of catch basin inserts. Clearly, the Village's drainage infrastructure mapping effort should be the model for mapping drainage systems that discharge into the SSER.

As of September of 2007, when all of the questionnaires had been completed and returned to Bowne, 23 of the 39 responding government entities reported that their drainage infrastructure mapping efforts are in varying stages of progress, ranging from 25% to 95%. Of the government entities currently mapping their infrastructure, with the exception of Amityville, all are collecting outfalls and structures.

The remaining 6 surveyed municipalities reported that they have no plans to digitally map their drainage infrastructure. Possible reasons for the lack of drainage mapping in these municipalities include reliance upon historic maps and the absence of substantial drainage infrastructure. Though less discrete discharge conveyance mechanisms exist,

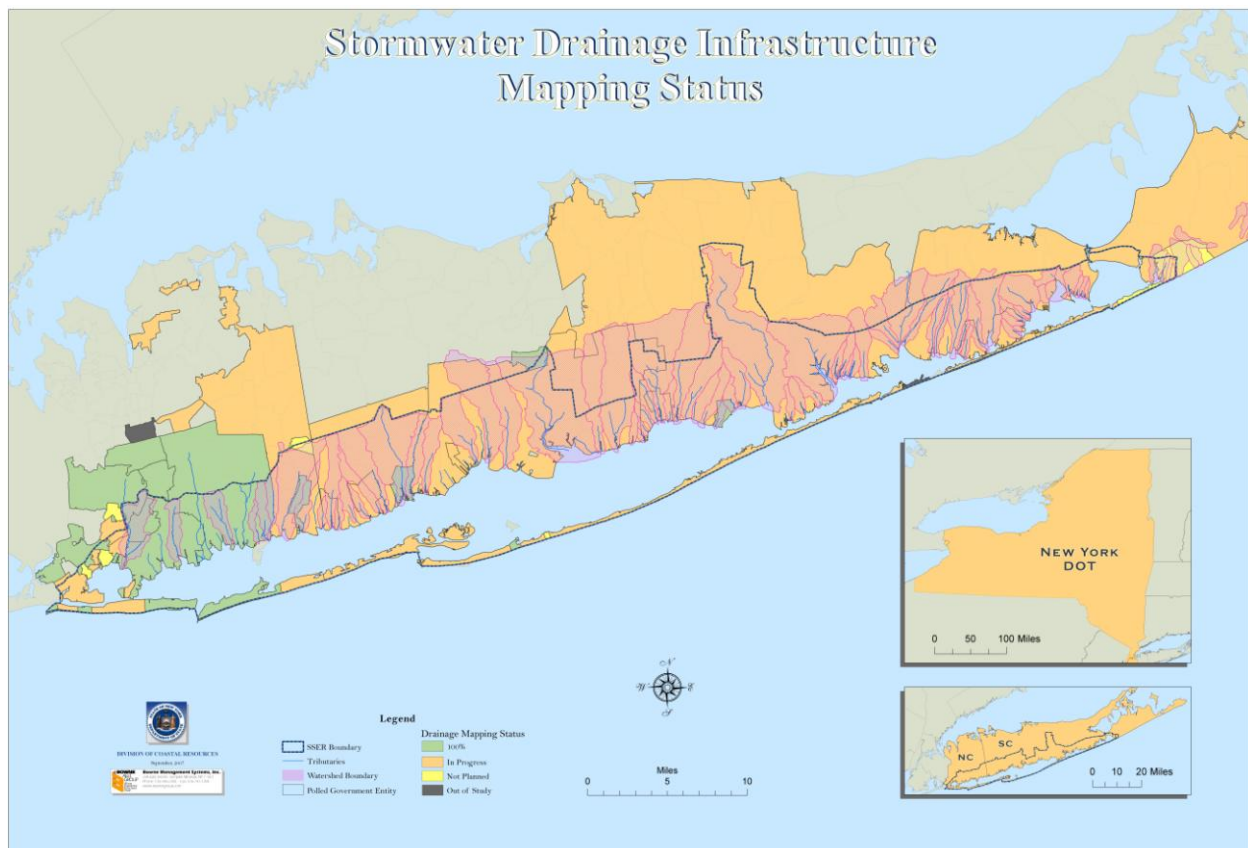
such as streets, municipalities tend not classify them as outfalls because of their potential for indiscriminate discharge.

Table 1 details the percentage of the municipal drainage systems that each of the 39 government entities reported collecting at the time they completed the questionnaire.

Government Entity Name	Permit Number	Drainage Infrastructure – Percent Digitally Mapped
CITY OF LONG BEACH	NYR20A189	60%
COUNTY OF NASSAU	NYR20A022	30%
COUNTY OF SUFFOLK	NYR20A180	50%
NYSDOT	NYR20A288	In Progress
TOWN OF BABYLON	NYR20A043	95%
TOWN OF BROOKHAVEN	NYR20A411	40%
TOWN OF HEMPSTEAD	NYR20A390	100%
TOWN OF ISLIP	NYR20A172	50%
TOWN OF OYSTER BAY	NYR20A371	50%
TOWN OF SOUTHAMPTON	NYR20A454	30%
VILLAGE OF AMITYVILLE	NYR20A419	65%
VILLAGE OF ATLANTIC BEACH	NYR20A097	75%
VILLAGE OF BABYLON	NYR20A008	100%
VILLAGE OF BELLPORT	NYR20A363	100%
VILLAGE OF BRIGHTWATERS	NYR20A021	50%
VILLAGE OF EAST ROCKAWAY	NYR20A410	75%
VILLAGE OF FARMINGDALE	NYR20A369	Not Planned
VILLAGE OF FREEPORT	NYR20A340	100%
VILLAGE OF GARDEN CITY	NYR20A070	100%
VILLAGE OF HEMPSTEAD	NYR20A051	100%
VILLAGE OF HEWLETT BAY PARK	NYR20A085	75%
VILLAGE OF HEWLETT HARBOR	NYR20A062	Not Planned
VILLAGE OF HEWLETT NECK	NYR20A090	75%
VILLAGE OF ISLAND PARK	NYR20A384	25%
VILLAGE OF ISLANDIA	NYR20A250	100%
VILLAGE OF LAWRENCE	NYR20A336	90%
VILLAGE OF LINDENHURST	NYR20A270	75%
VILLAGE OF LYNBROOK	NYR20A169	75%
VILLAGE OF MALVERNE	NYR20A450	Not Planned
VILLAGE OF MASSAPEQUA PARK	NYR20A063	100%
VILLAGE OF OCEAN BEACH		Not Planned
VILLAGE OF PATCHOGUE	NYR20A268	60%
VILLAGE OF QUOGUE	NYR20A455	30%
VILLAGE OF ROCKVILLE CENTRE	NYR20A061	100%
VILLAGE OF SALTAIRE		100%
VILLAGE OF SOUTHAMPTON	NYR20A456	Not Planned
VILLAGE OF WESTBURY	NYR20A408	75%
VILLAGE OF WESTHAMPTON BEACH	NYR20A457	80%
VILLAGE OF WOODSBURGH	NYR20A107	Not Planned

Table 1. Percentage of Mapped Drainage Infrastructure by Municipality

The following map reflects the status of drainage infrastructure mapping within the 39 government entities interviewed during this project.



4.2 NASSAU COUNTY

Over the last 15 years, Nassau County has taken the lead on Long Island in the development of an enterprise GIS system. The County has created a digital base map and developed extensive feature attributes fields, within which many of the specific details of drainage structures are stored. Municipalities within Nassau County have rights to a local extract of the County's existing GIS feature classes through a no-fee, multi-participant usage agreement. In exchange, they are required to return data that they develop so that it can be incorporated into the County's enterprise GIS.

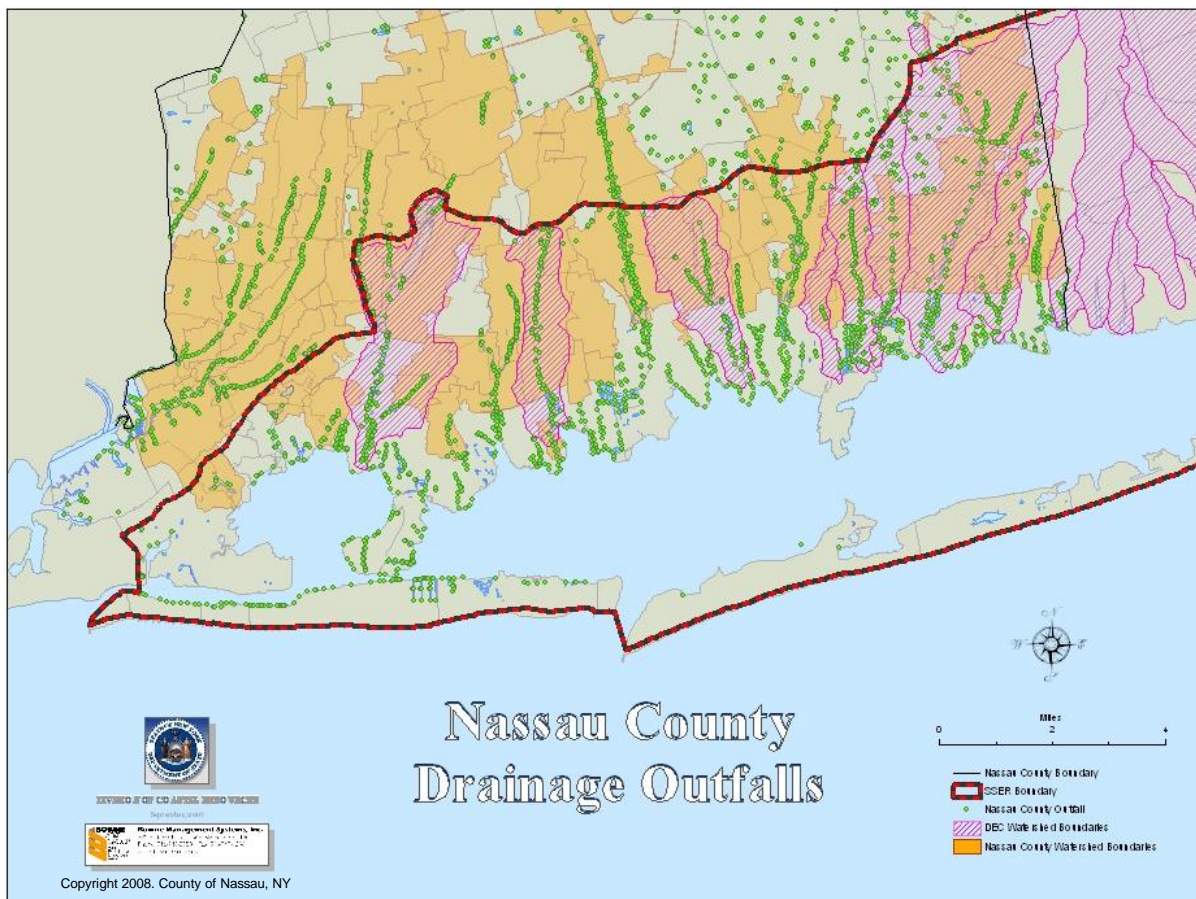
Nassau County has established a solid framework for comprehensive stormwater drainage system mapping. Their drainage mapping initiative has focused on system-wide data collection, including the State's minimum of outfall locations. Feature classes exist for all types of drainage infrastructure including outfalls, manholes, pipes, recharge basins and inlets.

Currently, Nassau County's GIS data includes a feature class called DrainageOutfall. Within this feature class, the County has established fields that contain the minimum specifications of each outfall. While the DEC guidance document calls for extensive

documentation of each outfall into additional data attribute fields, the County's data does store the essential information for each outfall collected.

Though Nassau County's GIS data does not entirely conform to the rigorous specifications recommended in the NYS DEC guidance document called "*Outfall and System Mapping Requirements for Illicit Discharge Detection and Elimination (IDDE) in New York*," it does provide a sound foundation upon which to build a complete storm sewer system GIS schematic. A more comprehensive discussion of the County's GIS data structure can be found in the Data Standards Recommendations chapter of this report.

During the late 1980's, Nassau County performed a stormwater outfall survey of all outfalls located on the County shoreline and interior water bodies. This survey included the location of Nassau County-owned pipes as well as other apparent outfalls, both public and private. For each outfall, the County recorded, as recommended by NYS DEC, X,Y coordinates, outfall ID, receiving waters, and outfall material (if applicable). The GIS data contains other recommended data fields, but they were not populated at the time of the survey. Nassau County now stores this outfall data in its enterprise-wide GIS. Below is an image of the assembled GIS points representing outfalls within the various watersheds in Nassau that discharge to the SSER.

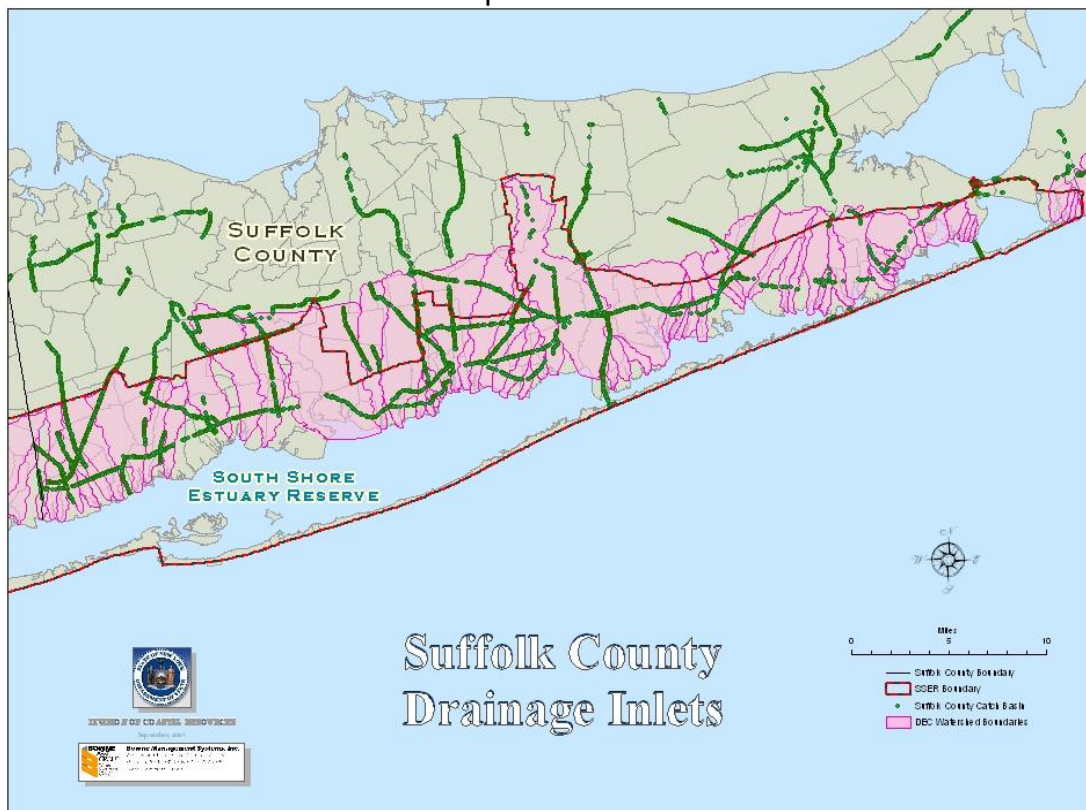


4.3 SUFFOLK COUNTY

Over the years, Suffolk County's GIS has evolved differently than Nassau County's GIS. In general, the County and the towns have each developed their own GIS systems in parallel, without much interchange of data. As a result, Suffolk County's enterprise GIS is not structured by a framework designed for central location of multi-source geospatial files. Suffolk County is, however, currently conducting a GIS needs assessment to determine the best approach to redefine its GIS and its data exchange relationships with local municipalities.

Suffolk County's approach to documenting its stormsewer system differs from Nassau County in that their digital mapping method is reversed. Though their initiative began after the return of their completed questionnaire, and is therefore not included in their reported data collection, Suffolk has started mapping the street drainage structures (i.e. manholes and catch basins.) With this approach, Suffolk is mapping the inlet or upstream end of its drainage system and working downstream to the eventual discharge point. By connecting these structures and following the topography, the County will ultimately digitally map the outfalls as well. Nassau County, on the other hand, began its mapping effort at outfalls, or discharges points, and will work upstream so that eventually the inlet structures will be mapped. When complete, both approaches will produce complete county drainage maps.

Below is a map of the Suffolk County catch basins and inlets that had been collected as of September 2007.



4.4 TIMING OF MUNICIPAL MAPPING OPERATIONS

New York State law requires urbanized communities in New York to establish local stormwater management programs by January 8, 2008. Mandated by this program is the location of points of discharge to surface waters and other municipal drainage systems components as necessary to track and eliminate illicit discharges, and to delineate their storm sewershed. Whether through CAD, GIS or historic paper maps, each of the government entities surveyed during this project have mapped their fixed, local discharge points, identified as outfalls. Many have continued to develop their drainage infrastructure data, collecting manhole, catch basin and pipe locations. The estimated dates for completion, by municipality, range from 1985 to 2012. Though data collected in 1985 would be out of date by now, the Village of Freeport has continued to supplement their data since the initial inventory, thus keeping the data current.

The following map depicts the 39 surveyed government entities and their respective anticipated or actual year of infrastructure mapping completion.

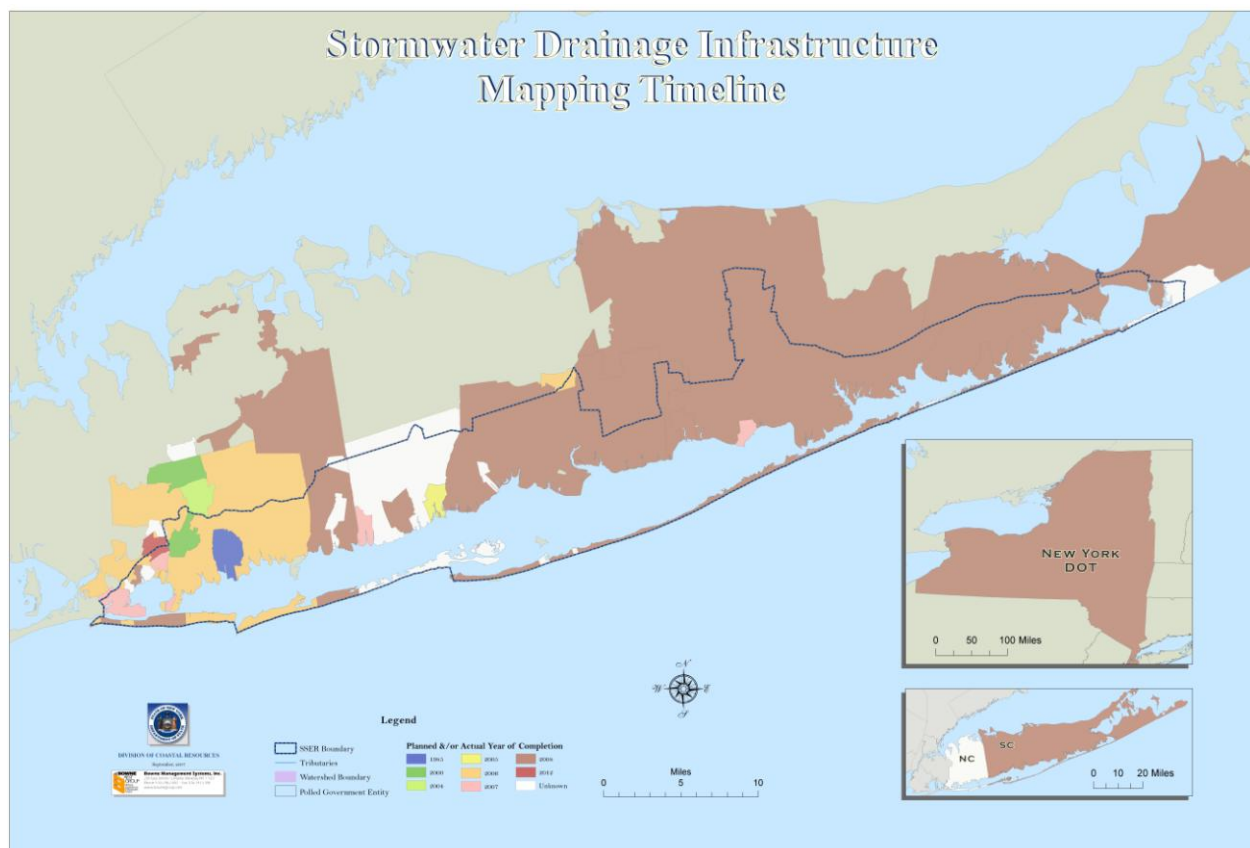


Table 2 details the specific dates reported by each GE for the completion of their drainage infrastructure digital mapping efforts.

Government Entity Name	Permit Number	Actual (or) Estimated Date of Completion as Reported by GEs
VILLAGE OF FREEPORT	NYR20A340	1985
VILLAGE OF GARDEN CITY	NYR20A070	2000
VILLAGE OF ROCKVILLE CENTRE	NYR20A061	10/1/2000
VILLAGE OF HEMPSTEAD	NYR20A051	1957 Rev. 2004
VILLAGE OF BABYLON	NYR20A008	2005
VILLAGE OF ISLANDIA	NYR20A250	2006
TOWN OF HEMPSTEAD	NYR20A390	8/8/2006
VILLAGE OF AMITYVILLE	NYR20A419	2007
VILLAGE OF EAST ROCKAWAY	NYR20A410	2007
VILLAGE OF BELLPORT	NYR20A363	7/1/2007
VILLAGE OF LAWRENCE	NYR20A336	9/1/2007
VILLAGE OF ISLAND PARK	NYR20A384	10/1/2007
TOWN OF BROOKHAVEN	NYR20A411	2008
TOWN OF ISLIP	NYR20A172	2008
TOWN OF OYSTER BAY	NYR20A371	2008
VILLAGE OF LINDENHURST	NYR20A270	2008
COUNTY OF SUFFOLK	NYR20A180	1/1/2008
NYSDOT	NYR20A288	1/1/2008
VILLAGE OF HEWLETT BAY PARK	NYR20A085	1/1/2008
VILLAGE OF HEWLETT NECK	NYR20A090	1/1/2008
CITY OF LONG BEACH	NYR20A189	3/1/2008
VILLAGE OF ATLANTIC BEACH	NYR20A097	3/1/2008
VILLAGE OF WESTBURY	NYR20A408	3/1/2008
TOWN OF SOUTHAMPTON	NYR20A454	8/1/2008
VILLAGE OF QUOGUE	NYR20A455	8/1/2008
VILLAGE OF WESTHAMPTON BEACH	NYR20A457	8/1/2008
VILLAGE OF PATCHOGUE	NYR20A268	12/1/2008
VILLAGE OF LYNBROOK	NYR20A169	2012
VILLAGE OF FARMINGDALE	NYR20A369	Not Planned
VILLAGE OF HEWLETT HARBOR	NYR20A062	Not Planned
VILLAGE OF MALVERNE	NYR20A450	Not Planned
VILLAGE OF OCEAN BEACH		Not Planned
VILLAGE OF SOUTHAMPTON	NYR20A456	Not Planned
VILLAGE OF WOODSBURGH	NYR20A107	Not Planned
COUNTY OF NASSAU	NYR20A022	Not Reported
TOWN OF BABYLON	NYR20A043	Not Reported
VILLAGE OF BRIGHTWATERS	NYR20A021	Not Reported
VILLAGE OF MASSAPEQUA PARK	NYR20A063	Not Reported
VILLAGE OF SALTAIRE		Not Reported

Table 2. Actual or Estimated Dates of Drainage Mapping Completion by Municipality

4.5 MAPPING METHODS AND DATA DICTIONARY

Digital mapping methods vary greatly between municipalities. Most government entities begin the process by simply scanning their historic paper plans and then digitizing them into GIS or CAD (i.e. map review). Others have field-checked the maps either by random spot-checking or by conducting a 100% field verification. Still others are using GPS (global positioning system) to locate and verify locations of drainage structures. Regardless of the method by which GEs collect information, they all collect data under predetermined guidelines, or a data dictionary.

A data dictionary is, quite simply, the rules under which data is collected. A data dictionary contains information regarding data relationships, attribute field types, names, and lengths. Once established, a data dictionary is the guide by which all data is compiled and sorted. According to the NYS DEC guidance document, *“Outfall and System Mapping Requirements for Illicit Discharge Detection and Elimination (IDDE) in New York,”* data regarding outfalls should follow the data dictionary specified below.

Field	Type	Length	Attributes	Description
<u>MS4 Permit #</u>	character	9	NYRxxxxxx	DEC MS4 permit number
XY coordinate of the outfall or interconnection	numeric	X=6 digits Y=7 digits no decimal		Coordinate values
Outfall ID	character	6		See notes below
Source of X, Y data	character	10	GPS, map, etc	Method of data collection
HUC #	numeric	11	11 digit	Hydrologic Unit Code
Waters of NY name	character	30		
Waters of NY ID	character	20	NHD reach-ID number or WIN	Sample NHD provided on CD Refer to NYCRR
Receiving MS4	character	9	None	same MS4
			Permit # (NYRxxxxxx)	Discharge to another regulated MS4,
			SWIS code (xxxxxx)	Discharge to non-regulated MD4
Outfall type	character	15	pipe, culvert, ditch/swale, seep, catch basin/manhole	Or use appropriate numeric code
Mode of Entry	character		Direct	Discharge to an identified NY water
			MS4	Discharge to another regulated MS4
			Indirect	Discharge via hydraulically unconnected wetlands, overland flow, Intermittent/unidentified stream (no WIN)

Confidence Level	character		Verified Calculated Historical data None	Verified with field observation, Educated guess or desk calculated, Existing records or previous knowledge No records
Notes	character	250		

Table 3. Recommended minimum-recorded outfall attributes. *“Outfall and System Mapping Requirements for Illicit Discharge Detection and Elimination (IDDE) in New York”*, NYS DEC. October 8, 2004

Specific data dictionaries, of course, will vary between municipalities. Most government entities however, are at least consistent with the type of data collected. Whether in CAD or GIS, manholes, catch basins and outfalls are stored as point features. Drainage pipes are stored as lines. Thirteen of the surveyed government entities report maintaining data terminology that is consistent with that of the NYS DEC *“Outfall and System Mapping Requirements for Illicit Discharge Detection and Elimination (IDDE) in New York.”*

The table below outlines the varying level of detail collected by each of the 39 GEs, and if they consider their data collection efforts to be in accordance with the State’s recommendations listed above.

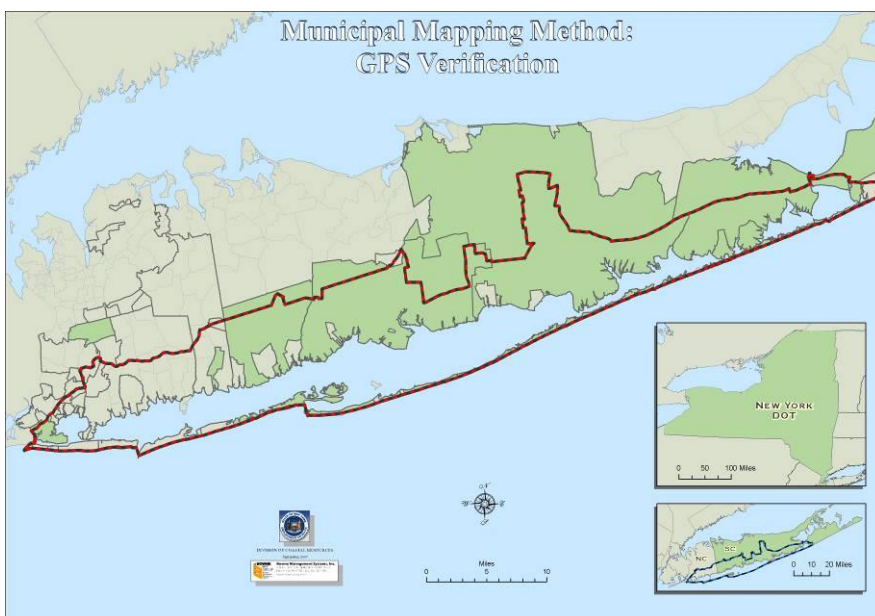
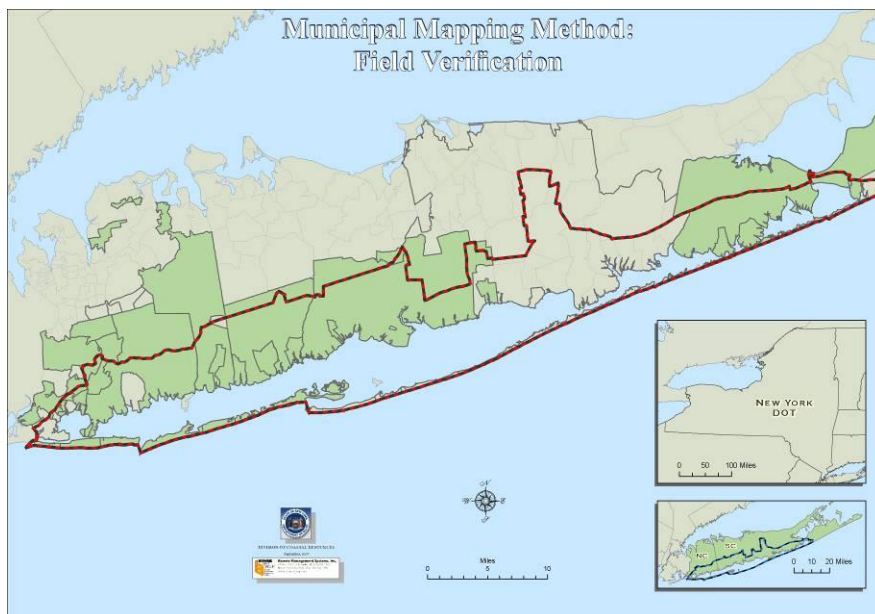
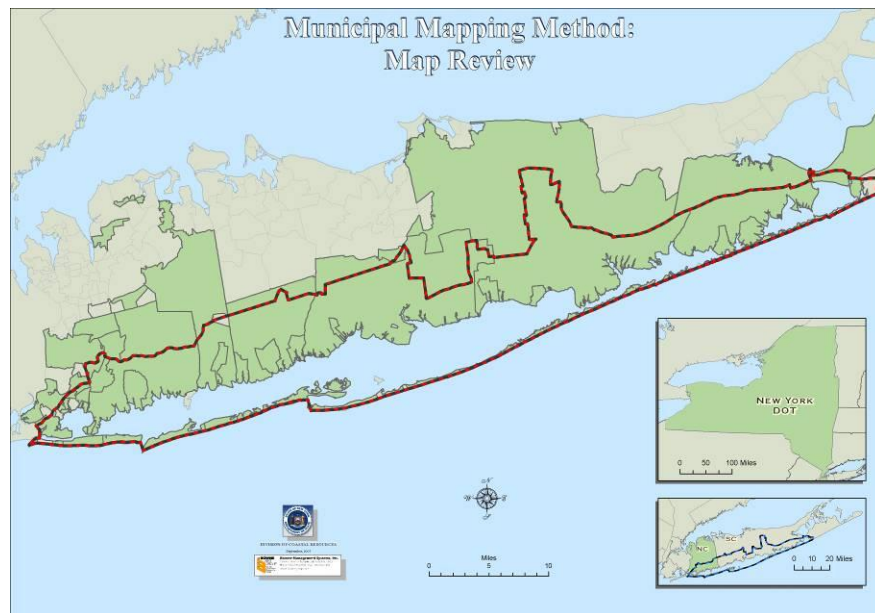
GE Name	Follow DEC Rec.	Outfall Attributes Collected	Outfalls and Network	Pipes	Open Channels	Drainage Ditches	Street Gutters	Outfall Size	Material	Tide Gates	Outfall ID	Receiving Waters	Water Index Number (HUC)	Hydrologic Unit Code (HUC)	NHD Reach #	Field Data	Presence of Dry Weather Flow	Presence of Turbidity or Stains	Presence of Discoloration	Presence of Clog or Obstruction	Presence of Cracks or Breaks
Cities																					
LONG BEACH			X																		
Counties																					
NASSAU			X	X	X	X			X		X						X	X	X	X	X
SUFFOLK			X		X		X	X	X	X	X						X	X	X	X	X
State																					
NYSDOT	X		X		X	X	X	X		X	X		X				X	X	X	X	X
Towns																					
BABYLON			X										X				X	X	X	X	X
BROOKHAVEN	X		X																	X	X
HEMPSTEAD	X		X														X	X	X	X	X
ISLIP			X										X							X	X
OYSTER BAY	X		X																	X	
SOUTHAMPTON	X		X										X	X	X		X	X	X	X	X
Villages																					
AMITYVILLE	X		X		X	X			X	X	X		X					X	X	X	X
ATLANTIC BEACH			X										X								
BABYLON			X										X								
BELLPORT			X										X				X	X	X	X	
BRIGHTWATERS	X		X										X								
EAST ROCKAWAY			X										X							X	X
FARMINGDALE																					
FREEPORT			X																		
GARDEN CITY			X																		
HEMPSTEAD	X		X		X	X		X	X				X	X	X						
HEWLETT BAY PARK			X																		
HEWLETT HARBOR																					
HEWLETT NECK			X																		
ISLAND PARK	X												X								
ISLANDIA	X		X				X						X				X	X	X	X	X
LAWRENCE			X														X	X	X	X	X
LINDENHURST	X		X										X				X	X	X	X	X
LYNBROOK													X				X	X	X	X	X
MALVERNE																					
MASSAPEQUA PARK			X										X								
OCEAN BEACH																					
PATCHOGUE			X										X					X		X	X
QUOGUE	X		X										X	X	X		X	X	X	X	X
ROCKVILLE CENTRE			X										X				X	X	X	X	X
SALTAIRE																					
SOUTHAMPTON																					
WESTBURY			X															X		X	X
WESTHAMPTON BEACH	X		X										X	X	X	X	X	X	X	X	X
WOODSBURGH			X																		

Table 4. Questionnaire Results pertaining to Outfall data

GEName	Map Review	Field Inspection	GPS Verification
CITY OF LONG BEACH	X	X	
COUNTY OF NASSAU	X		
COUNTY OF SUFFOLK		X	X
NYS DOT	X		X
TOWN OF BABYLON	X	X	X
TOWN OF BROOKHAVEN	X		X
TOWN OF HEMPSTEAD	X	X	
TOWN OF ISLIP	X	X	X
TOWN OF OYSTER BAY	X	X	
TOWN OF SOUTHAMPTON	X	X	X
VILLAGE OF AMITYVILLE	X	X	
VILLAGE OF ATLANTIC BEACH		X	
VILLAGE OF BABYLON	X	X	
VILLAGE OF BELLPORT	X		
VILLAGE OF BRIGHTWATERS	X	X	
VILLAGE OF EAST ROCKAWAY	X	X	
VILLAGE OF FARMINGDALE			
VILLAGE OF FREEPORT	X		
VILLAGE OF GARDEN CITY	X	X	X
VILLAGE OF HEMPSTEAD	X	X	
VILLAGE OF HEWLETT BAY PARK	X	X	
VILLAGE OF HEWLETT HARBOR			
VILLAGE OF HEWLETT NECK	X	X	
VILLAGE OF ISLAND PARK	X	X	
VILLAGE OF ISLANDIA	X	X	
VILLAGE OF LAWRENCE	X		X
VILLAGE OF LINDENHURST	X	X	
VILLAGE OF LYNBROOK	X	X	
VILLAGE OF MALVERNE			
VILLAGE OF MASSAPEQUA PARK	X	X	X
VILLAGE OF OCEAN BEACH			
VILLAGE OF PATCHOGUE	X	X	
VILLAGE OF QUOGUE	X	X	X
VILLAGE OF ROCKVILLE CENTRE	X	X	
VILLAGE OF SALTAIRE			
VILLAGE OF SOUTHAMPTON			
VILLAGE OF WESTBURY	X		
VILLAGE OF WESTHAMPTON BEACH	X	X	X
VILLAGE OF WOODSBURGH	X	X	

Table 5. Reported Data Verification Methods by municipality

The following maps represent the various methods by which municipalities within the SSER have chosen to map and verify their drainage infrastructure data.



5. CONCLUSIONS

The 39 individual municipalities included in this stormwater mapping inventory collected varying levels of their drainage system mapping components, as mandated by New York State DEC. Each has purportedly mapped the locations of their system outfalls on hard copy maps, many extending their local mapping effort to include structures system-wide in a digital mapping format. Although the government entities have each mapped portions of their drainage systems, few are members of data sharing cooperatives, thus each municipality stores its data independently of other neighboring government entities. This has the potential to create a data silo scenario whereby multiple versions of like data are stored and maintained without recognition of each other.

Nassau County maintains a data-sharing cooperative with all of the municipalities located within the County. Suffolk County, too, is beginning to reach out to its municipalities in an effort to develop a central GIS data repository. Once established, this program will provide a better means of communicating data requests and changes between County departments and local municipalities. In the future, Suffolk County plans to include their 10 encompassed towns and many villages in their GIS cooperative as well.

The higher the quality of the municipal data, the better informed the Council will be while developing their policies and analyzing potential pollution loads. Not only will this inventory benefit the public stormwater system, and thereby the SSER, it will provide incentive for government entities to collect and maintain up to date and accurate data regarding their infrastructure.

The objective of the illicit discharge detection and elimination minimum control measure is to detect and eliminate illicit discharges to the storm sewer system. Digital storm sewer mapping is a tool that provides a better overall picture for use toward achieving of that objective. With the information gathered during this municipal drainage infrastructure assessment, the Council is now able to make more informed recommendations on municipal, best management practices (BMP) for the elimination of illicit discharge. Stormsewershed/drainage area mapping also provides a more accurate basis for watershed management and the planning, implementation, and assessment of source control. The data derived from the drainage questionnaires will enable better decisions regarding the water quality within the Reserve with respect to non-point source pollutants.

The next logical phase of this project, data comparison and assembly, is of utmost importance should the Council wish to take full advantage of the complete GIS assessment and inventory.

6. RECOMMENDATIONS

6.1 GENERAL RECOMMENDATIONS

The Council should use the findings of this project as the basis for any future assessment, planning or recommendations to municipalities regarding drainage infrastructure design or control. The Council should also, as needed, reach out to access and review the drainage data developed and maintained by the 39 government entities surveyed as part of this project.

1. The County of Nassau has developed a large amount of drainage data in its enterprise GIS database. Currently, within the bounds of the Reserve, the County maintains over 2200 outfalls, 4000 catch basins, 2300 manholes, and over 6000 drainage pipe segments. The County is also working with the Town of Oyster Bay to develop GIS drainage data for the entire south shore of the Town. At the time of the survey, the Town had digitized approximately 50% of its drainage infrastructure. Since then, the Town has completed their effort, mapping 100% of its outfalls that lead to the SSER. As the data was developed, in accordance with the Nassau County GIS Basemap License Agreement, the Town returned the data to the County for loading into the County's GIS database.

Through DOS, the Council is also a member of the Nassau County GIS data sharing cooperative. The Council should take advantage of its existing multi-participant license with Nassau County to access and analyze this extensive drainage infrastructure resource.

2. For the government entities that have mapped their drainage infrastructure on paper, the Council should encourage a program through which the paper maps are converted to digital data and stored based on the common GIS protocol (Table 3.) described in the NYS DEC guidance document, *"Outfall and System Mapping Requirements for Illicit Discharge Detection and Elimination in New York."* Incorporating these paper-based drainage networks into an enterprise GIS dataset can be accomplished in two phases.

Phase 1. - The program should encourage the scanning and georeferencing (rubbersheeting) of existing plans, and the digitization of the data currently limited to existing paper maps. The result would be a comprehensive, Reserve-wide drainage infrastructure dataset. It will provide an invaluable schematic of the municipal drainage networks throughout Long Island, at the very least, differentiated by structure type and ownership. In many cases, however, the data includes substantially more information regarding the drainage infrastructure.

In order to provide the Council with the information necessary to estimate the number of hours required to complete phase one of our recommended program, Bowne created sample GIS data for two municipalities. The Villages of Hewlett Neck and Hewlett Bay Park were used as a test to determine the time required to convert existing

plans to digital data. Existing maps from the villages were scanned, converted to an appropriate file type, georeferenced and interpreted in order to create digital GIS representations of the recorded data. The Council should consider the following, resulting timetable when reviewing the process of converting paper drainage maps to GIS.

Process	Approx. Duration
Scan Paper Plans	10 minutes per sheet
Process Image Files (convert to Huffman tiff, crop, build pyramids & statistics)	20 minutes per sheet
Georeference Images in GIS	15 minutes per sheet
Digitize features into GIS	100 Features per hour (Additional time required for extensive attributes)

Recently, Nassau County commissioned the development of a Stormwater Runoff Impact Analysis Procedure Manual. Section 3.1 of the manual recommends appropriate steps for the conversion of paper maps into digital data. The recommendations include the conversion of basemap GIS data into a CAD drawing, the rubbersheeting of a scanned drainage plan, digitizing of drainage data from the images into the CAD, and then a final conversion back into a compatible GIS format. Though this solution does produce the intended result, it also requires a user to export GIS data from its original format only to load it back in at the end of the process. The Council need not encourage the additional step of conversion to CAD, as all of the procedures necessary to extract the drainage information from paper plans exist within the native GIS software environment. In addition, NYS DEC prefers that municipalities store their stormwater infrastructure data in GIS.

Source: Cashin Associates P.C., 10/1/2007. Nassau County Stormwater Management Program, *Stormwater Runoff Impact Analysis Procedure Manual*

NYS DEC, October 8, 2004. *Outfall and System Mapping Requirements for Illicit Discharge Detection and Elimination (IDDE) in New York*

Phase 2. – Phase two of this program should focus on the field verification of the structures digitized in Phase 1. In the draft of the next MS4, 5-year SPDES permit, a required condition of the 3rd minimum control measure is that each GE must field verify their drainage outfalls over a 5-year period. At the time of this inspection, each GE should attempt to collect as much of the NYS DEC recommended data about the outfalls as possible. Table 3. outlines the minimum recommended attributes that each GE should collect for their identified outfalls. NYS DEC also recommends the use of a Global Positioning System (GPS) for a more accurate field verification product. The use of GPS will provide a smoother transition of field verification notes into municipal GIS. Not only will the conformity of GEs to the State requirements lead to a better data product, it will also facilitate the creation of an Island wide drainage dataset in the future. Source: New York State DEC, Fact Sheet, *SPDES General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s) (GP-0-08-002)*

6.2 DATA STANDARDS RECOMMENDATIONS

Without a single data schema, the digital data from the varying municipalities may not merge correctly. Without attribute standards, fields and data types will not match. Both a spatial reference and attribute protocol must be followed to ensure that all data collected can be incorporated into the potential drainage GIS database by the Reserve. The Council should adopt the guidelines issued by USEPA and NYS DEC and encourage municipalities to adhere to the specifications outlined in Table 3.

As recommended by NYS DEC, municipalities should develop their GIS data while adhering to spatial reference coordinate standard of either Universal Transverse Mercator (UTM) or State Plane Feet. Regardless of which spatial reference standard is chosen, GEs are required to return data to NYS DEC in UTM. Data collected in the State Plane projection is easily converted to UTM. Both are practical and accurate spatial reference systems and should be the Island standard for stormsewer infrastructure data collection. Source: NYS DEC, October 8, 2004. *Outfall and System Mapping Requirements for Illicit Discharge Detection and Elimination (IDDE) in New York*

Nassau County, working under a grant from NYS DEC, recently examined its mapping protocol with guidance from NYSDEC, USEPA, NEIWPCC and CWP. The County's GIS data contains many of the NYS DEC recommended data fields for outfalls, including XY coordinates, receiving waters, size, material, and outfall ID. The County data excludes, however, several data fields that NYS DEC recommends, such as Hydrologic Unit Code (HUC), National Hydrography Dataset ID (NHD), Receiving MS4, Mode of Entry and Confidence Level. Several of the data fields DEC recommends for recording field observations are also absent from the County's existing GIS data structure. The fields recommended by NYS DEC such as Functioning, Flow Amount, Odor, Color, Turbidity, Floatables, and Deposit have not been created in the County data, but they can be easily incorporated into the County's existing text field called Physical Description, or added as new attribute fields.

If known, municipalities should include discharge reach information in their GIS data collection efforts. This may be in the form of HUD, NHD or simply a text entry for WIN. Field observation data can be included as additional attribute fields or recorded as a related data table. The advantage of storing the observation data as a related table is that municipalities can document several different inspections and recall the data in GIS as needed. If the field observation data were to be stored in GIS attribute fields, the data would become too cumbersome to query easily. By entering field observation data into related tables based on a unique outfall ID, municipalities are able to use the Nassau County GIS data structure as a starting point, customizing the data for their specific system and inspection schedules.

Since Nassau County maintains an enterprise GIS that encompasses approximately half of the of government entities within the Reserve, its existing database structure and

data schema can be used as a resource for implementing new municipal mapping protocols that are consistent with state/federal recommendations. Municipalities who are developing their GIS should look to the County GIS data structure as a model for development.

In addition to the fields currently stored in the Nassau County GIS, municipalities should refer to the clear data recommendations set forth by NYS DEC in the guidance document, “Outfall and System Mapping Requirements for Illicit Discharge Detection and Elimination (IDDE) in New York.” If specific sewersheds are unknown, municipalities should take advantage of the spatial boundaries that the DEC maintains for each of the watersheds within the Reserve. A simple spatial join within a GIS will accommodate this DEC data requirement.

Suffolk County towns and villages should also be encouraged to partner in stormwater data collection initiatives and data warehousing. They should apply for assistance from the Shared Municipal Services Incentive Program (SMSI), administered by the New York State Department of State, as a means of consolidating and coordinating their data collection efforts.

As more Long Island villages and towns begin to develop GIS as a means of recording and reporting critical information regarding their stormwater infrastructure, so grows the opportunity to create a seamless, field verified, Island-wide GIS dataset. This report is only the first step in the development of such a dataset. Though the statistical information reported in this document is vital for the understanding of the current state of stormsewer data on the Island, the eventual goal of a single dataset depends on the continued support and cooperation of all Government Entities involved.

7. APPENDICES

7.1 APPENDIX A - MUNICIPAL DRAINAGE CONTACTS

Government Entity Name	Permit Number	Listed Contact	Listed Title
City Of Long Beach	NYR20A189	Joseph Febrizio	Deputy Commissioner of Public Works
County Of Nassau	NYR20A022	Kenneth Arnold	Sanitary Engineer IV
County Of Suffolk	NYR20A180	Gilbert Anderson	Commissioner of Public Works
NYSDOT	NYR20A288	Darrel Kost	Resident Engineer
Town Of Babylon	NYR20A043	Richard Groh & Joseph Guarino	Chief Env. Analyst & Principal Env. Analyst
Town Of Brookhaven	NYR20A411	Alan Svoboda	Planning Director
Town Of Hempstead	NYR20A390	<i>Unlisted</i>	
Town Of Islip	NYR20A172	David Genaway	Town Planning Director
Town Of Oyster Bay	NYR20A371	<i>Unlisted</i>	
Town Of Southampton	NYR20A454	Walter Bundy	Stormwater Manager, Town of Southampton
Village Of Amityville	NYR20A419	<i>Unlisted</i>	
Village Of Atlantic Beach	NYR20A097	Steven Churson	Supt. Of Public Works
Village Of Babylon	NYR20A008	Jeffrey Patanjo	Village Engineer - Savik & Murray, LLP
Village Of Bellport	NYR20A363	Carrie O'Farrell	Rep from Nelson, Pope & Voorhis, LLC
Village Of Brightwaters	NYR20A021	R.W. Fischer	Village Trustee
Village Of East Rockaway	NYR20A410	Dennis McCabe	Supt. - Planning Dir. Building, Zoning & Code Enforcement
Village Of Farmingdale	NYR20A369	<i>Unlisted</i>	
Village Of Freeport	NYR20A340	Rob Fisenne	Village Engineer
Village Of Garden City	NYR20A070	Robert Mangan	Director of Public Works
Village Of Hempstead	NYR20A051	Harry Dickenson	Public Works
Village Of Hewlett Bay Park	NYR20A085	Marie Velotti	Village Clerk
Village Of Hewlett Harbor	NYR20A062	<i>Unlisted</i>	
Village Of Hewlett Neck	NYR20A090	Marie Velotti	Village Clerk
Village Of Island Park	NYR20A384	Joe Di Domenico	Supt. Of Public Works
Village Of Islandia	NYR20A250	Jeffrey Kasner	Manager of Environmental Programs, Cashin Associates
Village Of Lawrence	NYR20A336	Daniel Herron	Deputy Administrator
Village Of Lindenhurst	NYR20A270	Douglas Madlon	Deputy Administrator
Village Of Lynbrook	NYR20A169	Philip Healey	Supt. Of Public Works
Village Of Malverne	NYR20A450	Teresa Emmel & Paul Jessup	Clerk, Treasurer & DPW Supt.
Village Of Massapequa Park	NYR20A063	John LaMarca	Acting Supt. Of Public Works
Village Of Ocean Beach		<i>Unlisted</i>	
Village Of Patchogue	NYR20A268	Paul Pontieri	Mayor
Village Of Quogue	NYR20A455	Walter Bundy	Stormwater Manager, Town of Southampton
Village Of Rockville Centre	NYR20A061	Steve Kritsas	Deputy Administrator, Village Engineer
Village Of Saltaire		<i>Unlisted</i>	
Village Of Southampton	NYR20A456	<i>Unlisted</i>	
Village Of Westbury	NYR20A408	Ted Blach	Supt. Of Public Works
Village Of Westhampton Beach	NYR20A457	Walter Bundy	Stormwater Manager, Town of Southampton
Village Of Woodsburgh	NYR20A107	Marie Velotti	Village Clerk

7.2 APPENDIX B - REFERENCES

Cashin Associates P.C., 10/1/2007. Nassau County Stormwater Management Program, *Stormwater Runoff Impact Analysis Procedure Manual*

New York State DEC, October 8, 2004. *Outfall and System Mapping Requirements for Illicit Discharge Detection and Elimination (IDDE) in New York*

New York State DEC, Fact Sheet, *SPDES General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s) (GP-0-08-002)*

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Philip Campman, Database Design and Process Modeling for a Drainage Utility GIS, June 2007. http://gis.esri.com/library/userconf/proc07/papers/papers/pap_1662.pdf

United States Geological Survey U.S.G.S. Water Resources, (2008).
<http://water.usgs.gov/>

7.3 APPENDIX C - QUESTIONNAIRE